## REMARKS

A. Request for Reconsideration

Applicant has carefully considered the matters raised by the Examiner in the outstanding Office Action but remains of the position that patentable subject matter is present. Applicant respectfully requests reconsideration of the Examiner's position based on the amendments to the claims and the following remarks.

B. Claim Status and Amendments

Claims 1-7 are presented for further prosecution.

Claim 8 has been cancelled.

No new matter was added.

C. The Invention

The present invention relates to an elastomeric compound having a high filler content of 15% to 500% by weight of the compound, which additionally contains 1 to 400% by weight of the compound of microsilica as a modifier to improve the processability.

As discussed in the specification, the "high filler loading" means an elastomeric compound having such a filler

loading amount that the viscosity will increase to such a level that the compound can not be processed. The invention solves this processibility problem by adding 1 to 400 % by weight of microsilica to such a highly loaded elastomeric compounds already having a high filler content of 15% to 500% by weight.

The term microsilica used in the specification and claims is particulate amorphous $SiO_2$ obtained from a process in which silica is reduced to SiO-gas and the reduction product is oxidized in vapor phase to form amorphous silica. Microsilica may contain at least 70% by weight silica ($SiO_2$) and has a specific density of 2.1 - 2.3 $g/cm^3$ and a surface area of 15 - 50 $mg^2/g$.

D. The Office Action

1. Double Patenting Rejections

Claims 1-8 had been rejected as being obvious in view of the copending Application No. 11/718590.

Applicants note that the Examiner has held this Double Patenting Rejection in abeyance until this case is ready for allowance ($2^{nd}$ Paragraph, Page 9 of the Office Action).

2. Claim Rejections under 35 USC § 112

Claim 8 had been rejected under 35 U.S.C. 112 as being non-compliance with the written description requirement.

Applicant has cancelled claim 8.

3. Claim Rejections - 35 USC § 103

Claims 1-8 had been rejected under 35 U.S.C. 103(a) as being unpatentable over Mitsuhashi in view of Underwood.

Regarding Mitsuhashi

Mitsuhashi teaches a fire-retardant silicone rubber composition with 10-100 parts by weight silica powder, selected from mist silica, hydrophobic silica, set process silica and the end of quartz powder. The examiner takes the position that mist silica is fumed silica and Fumed silica is microsilica. Applicant respectfully disagrees.

As recited in Claim 1, the present invention requires:

*"wherein the microsilica is particulate amorphous SiO2 obtained from a process in which silica is reduced to SiO-gas and oxidized in vapor phase to form amorphous silica which contains at least 70% by weight silica (SiO2) and has a specific density of 2.1 - 2.3 g/cm3 and a surface area of 15 - 40 m2/g, and has primary particles being substantially spherical with an average size of about 0.15 μm."*

Fumed silica is different from the above specified microsilica in the present invention. Microsilica is obtained from a process in which silica is reduced to SiO-gas and oxidized in vapor phase to form amorphous silica. Fumed silica, however, is made by burning silicon tetrachloride in a flame of hydrogen and oxygen (at approximately 1800 $^{o}$C) to produce molten spheres of silicon dioxide (and hydrogen chloride).. The molten spheres collide and fuse with one another to form branched, three-dimensional chain-like aggregates (See attached Product Information for Fumed Silica by Sigma).

Microsilica in this invention has a specific density of 2.1 - 2.3 g/cm$^3$ and a surface area of 15 - 40 m$^2$/g, and has primary particles being substantially spherical with an average size of about 0.15 $\mu$m. Seen from the Physical Property table in Sigma's product information, fumed silica has specific density of 2.1 - 4.5 lb/cu.ft and a surface area of 200-390 m$^2$/g, and an average size of about 0.007-0.014 $\mu$m. It is clear that the size of fumed silica particle is 10 times smaller and surface area is at least 10 times bigger than the specific microsilica in the present invention.

There is no mentioning of microsilica in Misuhashi. Misuhashi only discloses the silica powders having a size less than 50 um are preferred. Comparing with the preferred size of the microsilica in the present application, Misuhashi's silica powder is 330 times bigger.

Therefore, the position that fumed silica is miscrosilica, has no support from Misuhashi or other literature.

There are enormous varieties of the silica powders with a particle size less than 50 $\mu m$ are commercially available. One skilled in the art has no clue to shift his attention to an undisclosed special type of the silica powder, the microsilica, with the specific density, surface area and particle shape as recited in the present invention.

Therefore Misuhashi does not teach or suggest using microsilica in its compositions.

Regarding Underwood

The Examiner cited Underwood to teach a particulate amorphous silica and asserted that the combination of Misuhashi and Underwood reaches the claimed invention.

i. Underwood can not be combined with Misuhashi

Underwood teaches a solid resin composition of a **thermoplastic** resin and particulate amorphous silica as a filler. Underwood does not relate to **elastomeric** resins, such as the cross-linking treated silicon rubber in Mituhashi, although it is stated that the thermoplastic can include elastomers. Underwood clearly states (see column 2, lines 40-46, emphasis added):

> *"The so-called thermoplastic rubbers (thermoelastomers) [are] also included, since, as they include elastomeric domains and thermoplastic domains in the same polymer, they can be regarded as an "internal blend" of a thermoplastic resin and an elastomer.* ***Despite their name, the thermoplastic rubbers are to be regarded as plastics rather than rubbers as such, since no vulcanization is used in their manufacture."***

It is well known to the skilled of the art that, vulcanization or cross-linking process is a thermoset process, which is contrasted strongly with thermoplastic processes, a melt-freeze process. Misuhashi requires cross-linking treatment by adding a cross-linking accelerator platinum catalyst and a cross-linking agent, such as monotmethylsilane (Paragraph [0009-0011] of Misuhashi).

Thus, Misuhashi relates only to **cured rubber compounds** by an irreversible cross-linking reaction.

The cross-linking treatment in Misuhashi places Misuhashi outside the coverage of thermoplastic materials taught by Underwood. Since the silicone rubber material in Misuhashi is a thermoset material, which do not melt on heating as the thermoplastic material in Underwood, it is respectfully submitted that Underwood cannot be combined with Misuhashi.

ii. The combination of Underwood and Misuhashi does not teach adding microsilica to improve the processability of elastomers already having "high filler content".

It should be pointed out that none of the examples in Underwood contains high conventional filler content in addition to microsilica for processability.

The present invention relates to highly filled elastomeric compositions which contain conventional fillers and have microsilica as a processing agent. The high filler loading in the application increases the viscosity to a level where the processabillity is strongly reduced, which

makes it impossible to process the composition. The adding of microsilica as a processing agent in the present invention solves this problem.

Underwood does not teach or suggest microsilica can be used as a processing agent. Underwood teaches to use microsilica as a filler replacing conventional filler (calcium carbonate) in PVC. This is evident from all the compositions in the examples of Underwood; see Tables 3, 7, 8, 9 and 10. The advantages of the compositions according to the present invention compared to Underwood is that the present invention makes it possible to use very high amount of conventional filler and maintain excellent processability by adding microsilica.

Mitsuhashi does not suggest or imply a step of forming a highly filled elastomeric compound first and then adding microsilica to modify its processability either. Mitsuhashi does not teach a method for producing a highly filled elastomeric compound by adding this specific microsilica, nor does it teach a method of using the specific microsilica as a modifier to improve processability of a highly filled elastomeric compound.

It is respectfully submitted that it is not obvious from Mitsuhashi and Underwood to use the specific microsilica as recited in the invention to improve the processibility of a highly filled elastomeric composition. Therefore, the present invention as claimed in Claim 1-7 is patentable over Mitsuhashi and Underwood, stand alone or in combination.

E. Conclusion

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance and such action is respectfully requested. Should any extensions of time or fees be necessary in order to maintain this Application in pending condition, appropriate requests are hereby made and authorization is given to debit account #02-2275.

Respectfully submitted,

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# ProductInformation

**FUMED SILICA**
Product Number **S 5130**
**Replacement for Product Code 38,126-8**

**CAS NUMBER:** 112945-52-5
**SYNONYMS:** fumed silicon dioxide, Aerosil™, Cab-O-Sil™

**PHYSICAL DESCRIPTION:**

Fumed silica is composed of submicron-sized spheres, which are 40-60% fused into short chains, very highly branched, 0.1-0.2 microns long. The spheres are quite uniform in size for a given product, but the chain lengths are quite variable, 10 to 30 units in length. The surface area, which varies with the particle size, gives a good approximation of the sphere diameter. The smaller the particles, the larger the estimated surface area.[2]

| Sigma product | Particle size (µm) | Surface area ($m^2$/gram) | Density (lb/cu. ft) |
|---|---|---|---|
| S5130 | 0.007 | 390 ∀ 40 | 2.3 |
| S5255 | 0.008 | 325 ∀ 25 | 2.3 |
| S5380 | 0.011 | 255 ∀ 15 | 4.5 ∀ 0.5 |
| S2128 | 0.012 | 200 ∀ 25 | 2.3 |
| S5505 | 0.014 | 200 ∀ 25 | 2.3 |

**METHOD OF PREPARATION:**[2]

Silicon tetrachloride is burned in a flame of hydrogen and oxygen (at approximately 1800EC) to produce molten spheres of silicon dioxide (and hydrogen chloride). Depending on process parameters, the size of these silica spheres can be varied and, within a given batch, show excellent uniformity (by electron micrograph). The molten spheres collide and fuse with one another to form branched, three-dimensional chain-like aggregates.

**METHOD OF PREPARATION:**[2] (continued)

Many aggregates have chains from 10 to 30 spheres in length, or from 0.1 to 0.2 microns (µm) in length. As the aggregates cool down below the fusion temperature of silica (approximately 1710EC), further collisions result in some reversible mechanical entanglement or agglomeration. Further agglomeration occurs during the collection process; this can be reversed by proper dispersion in a suitable medium.

During the formation of the product, hydroxyl groups become attached to some of the silicon atoms on the surface of the silica particles, making the surface hydrophilic and capable of hydrogen bonding with suitable molecules. There are (estimated) 3.5-4.5 hydroxyl groups per square millimicron of silica surface, compared to a theoretical maximum of 7.85. The structure of fumed silica is amorphous (as indicated by absence of lines in its X-ray diffraction pattern.)

The surface area was determined by calculation using a nitrogen adsorption method of Brunauer[3], and the value used to calculate particle diameter.

The residual hydrogen chloride on the surface of the fumed silica was reduced to less than 200 ppm by calcining.[2] The moisture content of the product will vary, depending on storage conditions. Moisture adsorbed on the surface can be removed by evacuation at room temperature (at $10^{-2}$ mm Hg) or by heating at 110EC. (If the product is heated above 800EC, it sinters irreversibly.)

**STORAGE / STABILITY AS SUPPLIED:**

These products are stable indefinitely at room temperature if kept dry. Their tendency to adsorb moisture suggests an effective shelflife of about two years, once opened.

**SOLUBILITY / SOLUTION STABILITY:**[2]

Fumed silica will form dispersions in water, glycerine, butyl alcohol, mineral oil and a variety of other liquids, causing them to thicken or form gels. The dispersions often have thixotropic properties, i.e., viscosity that varies with rate of stirring.

For liquids with minimal hydrogen bonding, small amounts of fumed silica will increase the viscosity. Addition from 3 to 5% by weight usually suffices to cause the liquid to form a gel. After an initial thorough dispersion, increasing the mixing time has little effect on the viscosity for a given percent of silica.

For liquids with a high degree of hydrogen bonding, small amounts of fumed silica will also increase the viscosity. However, usually 10% or more (by weight) will be needed to form gels. The initial dispersion is rapid. If the dispersion is mixed too long, the result will be an irreversible decrease in viscosity.

**SOLUBILITY / SOLUTION STABILITY:**[2]

Dispersions formed with fumed silica are quite stable, remaining unchanged for weeks to months, over a range of temperatures.

**FUMED SILICA**
**Sigma Prod. Nos. S5130, S5255,**
**S5380, S2128 and S5505**

**USAGE:**

Fumed silica have been used commercially in a wide range of applications to enhance viscosity of many liquids, including paints. The most common application in biochemistry is for clarifying sera by removing lipids.

For years, serum could be delipidized very easily using a solvent, 1.1.2-trichlorotrifluoroethane (Sigma product number T5271). This was offered under a trade name "Lipoclean", and cited methods suggested the use of three parts solvent to two parts serum - or vice versa.[4] In 1993. OSHA-directed regulations became effective concerning the labeling of products exposed to chlorofluorocarbons (CFC's) during their manufacture. This has led to the need for alternate methods of clarifying serum-related products, especially if they are to be sold commercially.

Two methods are reported to be successful, each with its own limitations: dextran sulfate extraction and fumed silica precipitation. The use of dextran sulfate MW 500,000 (Sigma product number D6001) has been reported.[5] However, it does tend to bind blood clotting factors and, in fact, has been used to isolate factors II and X.[6] Use of fumed silica has generally been successful; one trade name reported is Aerosil 380; Sigma's comparable product is S5130, 0.007 micron particles.

**GENERAL PROCEDURE FOR DELIPIDIZING SERUM:**[6]

Add 20 g of fumed silica, Sigma product S5130/L serum (or 20 mg/mL serum), mix well for 2-3 hours or overnight. Centrifuge at 2000 g for 15 minutes. Wash the pelleted silica with buffer, then recentrifuge the supernatant liquid. Any pellet can be re-washed to recover as much serum as possible.

Disadvantages:

a. About 15% of the sample volume will be irretrievably lost, adsorbed to the silica.
b. The fumed silica is extremely fluffy and somewhat difficult to handle. The use of a fine-dust filter respirator is recommended. The fumed silica must be added as a dry powder to the serum, since once it is wet, the silica becomes very slimy and is extremely hard to handle as a heavy precipitate.
c. The silica is suitable for serum but cannot be used on plasma. The surface will activate clotting factors.

**REFERENCES:**


1. Sigma quality control.
2. Supplier data.
3. Brunauer, S. et al., *J. Am. Chem. Soc.*, 60, 309 (1938).
4. *Clin. Chim. Acta*, 148, 125-130 (1985) and *Clin. Chem.*, 36, 1675-1678 (1990).
5. Agnese et al., *Clin. Biochem.*, 16, 98-100 (1983).
6. Sigma production department.